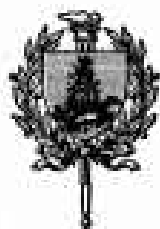


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# FARMERS' BULLETIN



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## COMMERCIAL VARIETIES OF ALFALFA.

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### INTRODUCTION.

It is only within the last 20 years that varieties of alfalfa have been recognized commercially in the United States, and only within the last 10 years have they been given really serious attention. Prior to 1898 no commercial distinction was made between the various lots of alfalfa seed sown in this country, whether they were of foreign or domestic origin. Coincident with the introduction of alfalfa into the various sections of the United States there developed an interest in varieties or strains for special conditions. This interest has resulted in the recognition and adoption of at least nine fairly distinct commercial varieties and strains. These varieties and strains show a great diversity in their adaptations to climatic conditions, some giving the best results in the cold North and Northwest, while others succeed only in the extreme South and Southwest, where the winter temperatures are very mild.

NOTE.—This bulletin is intended for general distribution and will be of interest to farmers in all parts of the United States where alfalfa can be grown.

These alfalfas have been produced for the most part in nature with almost no intentional effort on the part of man. The hybrid varieties are natural crosses, and the distinct types of pure origin are the products of natural selection. However, it is hoped that the results of the systematic plant breeding that has been conducted by the Department of Agriculture and the State agricultural experiment stations during the past decade will soon be available to the general public and that these efforts will produce strains or varieties of alfalfa that will be superior even to the best commercial ones that are now available. The present need is perhaps the greatest for alfalfas that will give profitable yields under the extreme conditions of moisture that exist, broadly speaking, in the West and in the East; that is, for the humid sections and for the semiarid sections, since in these sections the effort to extend the culture of alfalfa is the most active. While improved methods of culture will doubtless be an important factor in the ultimate success which alfalfa may attain in the semiarid and humid regions, nevertheless there is still much to be expected from better adapted varieties or strains.

The commercial alfalfas of this country may be divided into five somewhat distinct groups, each containing strains or varieties that vary considerably within themselves. These groups may be described briefly as follows:

The common group includes the ordinary purple-flowered, smooth alfalfa, of which there are numerous regional strains generally grown throughout the western part of the United States.

The Turkestan group includes alfalfas that have been developed in Turkestan. They differ from the common alfalfas of this country in that they are somewhat shorter and more spreading in habit of growth and are slightly more hairy. No commercial distinction is made between the various strains from Turkestan, all of them being sold under the name "Turkestan."

The variegated group includes the alfalfas that have originated from a cross between common alfalfa<sup>1</sup> and the yellow-flowered species.<sup>2</sup> The Grimm, Baltic, Canadian variegated, and sand lucern are the best known examples of this group.

The nonhardy group includes rather distinct varieties that are very susceptible to low temperatures. They are, in general, very erect in habit of growth, recover quickly after cutting, and have a long growing period. The Peruvian and Arabian varieties are members of this group.

The yellow-flowered group includes the various forms of the yellow-flowered species. They are easily distinguished from members of the other groups by their yellow flowers and crescent or sickle shaped pods.

In this bulletin the word "strain" is applied to alfalfas that are only slightly different from those that are typical of the ordinary purple-flowered alfalfa, and also occasionally to alfalfas that belong to other groups where they are considered with reference to these groups. The alfalfas of the common group that have developed in

<sup>1</sup> *Medicago sativa*.

<sup>2</sup> *Medicago falcata*.

various regions are called regional strains and not varieties, since they do not possess sufficiently distinct characters to be considered as varieties, while the Grimm alfalfa, for example, which is referred to as a variety when considered in connection with the common alfalfas, may be spoken of properly as a strain of variegated alfalfa.

Lack of distinct differences in the seeds of the various varieties and strains, and also in many cases in the appearance of their vegetative growth, has made it difficult for farmers to recognize them readily and has resulted in much careless and unscrupulous dealing on the part of seed producers and seedsmen. There seems to be such a general lack of knowledge with regard to the characteristics of our commercial alfalfas and so much misinformation has been circulated, which has resulted in many cases in disappointment and financial loss, that it is believed that an agronomic treatise on the varieties that have been quite generally advertised and more or less discussed in agricultural literature will be helpful at this time.

#### THE COMMON ALFALFA GROUP.

Comparatively little is known with regard to the origin of common cultivated alfalfa, although there is good reason to believe that it developed in western Asia and was one of the first plants to be cultivated solely for forage. Since alfalfa naturally is an open-fertilized plant, it is difficult to determine just how many strains are included in what we now call the common variety.

The alfalfa seed that was first sown in this country was introduced from various parts of Europe, but the stock from which most of the common alfalfa of our Western States has been produced was brought to Chile from Spain, and after having been grown there for many years was introduced into California about 1850. For lack of a better term it has been designated as "common alfalfa," or, to be more specific, the term "common alfalfa" has been used to include all of the alfalfas that are not clearly of hybrid origin or that do not have fairly distinct and uniform varietal characteristics, even though within this group what are known as regional strains are coming to be recognized.

In most lots of common alfalfa there occur some plants that grow more quickly than others after being cut. These plants also have a tendency to produce somewhat heavier yields and differ from the others in general habit of growth. They are more erect and have comparatively small crowns, which are produced well above the surface of the ground. In contrast to these there are plants that are slightly procumbent in habit of growth and have comparatively broad crowns, which are produced somewhat below the surface of the ground. The plants of the first type are favored by mild

climatic conditions, but succumb readily to severe winter conditions. This type of plant is sometimes referred to for convenience as the southern or nonhardy type. Plants of the second type are hardy and predominate as a result of the elimination of the more tender individuals in strains that have been developed in cold climates. This particular type is often referred to as the northern or hardy type. These two types of plants furnish a basis for the development of regional strains, which, as they are at present defined, are produced when common alfalfa is grown for several seed generations in definite localities where eliminating conditions of one kind or another normally prevail.

To illustrate what is meant by "seed generation," the seed produced from the original seeding may be said to be the first seed generation. If this be sown and seed produced from it, such seed would represent the second seed generation, and if this practice be continued for a considerable number of generations under eliminating conditions it will have a tendency to produce a fairly distinct strain of alfalfa.

It is not possible to formulate an entirely satisfactory definition for common alfalfa, since there is no sharp distinction between regional strains and distinct varieties. For example, certain well-recognized commercial varieties are probably nothing more than regional strains developed to a greater degree. The names of the regions in which these varieties have been developed are frequently applied to them as varietal designations, but they are commonly referred to as true varieties and not as regional strains. The Turkestan variety may be cited as an example of what is meant in this connection. A difference is now being recognized between lots of alfalfa that have been grown for several seed generations in the various States, and to such lots names of the States or terms descriptive of the conditions under which they were produced are sometimes applied; as, for example, Kansas-grown alfalfa, Montana-grown alfalfa, irrigated alfalfa, dry-land alfalfa, and many others. Certain regional strains produced in foreign countries are also recognized.

#### DOMESTIC STRAINS.

The names "Kansas-grown" or "Montana-grown" as used in the general seed trade are not necessarily distinctive. The mere fact that a certain lot of alfalfa seed was produced in Kansas or Montana is of no importance unless such lots of seed were produced as a result of several seed generations grown in these States. The same is true of seed indicated in the trade as "dry-land," "irrigated," and "nonirrigated" alfalfa, and it is safe to say that much undue discrimination has resulted in connection with their sale. Just how

many seed generations are required before a variety growing in one locality assumes rather definite characteristics doubtless varies with the nature of the eliminating climatic conditions and can not be estimated definitely. Fortunately, much of the seed that is grown in sections that produce seed with a fair degree of consistency has come from stock that has been grown in these sections for several seed generations. However, it is always well for a prospective purchaser to investigate this point if possible. The history of seed indicated as "dry-land" or "nonirrigated" should be investigated very carefully before purchasing if a price materially above the prevailing price for ordinary seed is asked, inasmuch as the history of such seed is often very uncertain.



FIG. 1.—A field of common alfalfa from Kansas-grown seed.

The so-called regional strains produced in Kansas, Oklahoma, and other States having similar conditions, have a tendency to recover more quickly after cutting and to give better yields than strains produced farther north. This characteristic has apparently been the result of climatic conditions favoring the perpetuation of the more rapid growing and high yielding individuals until a strain is produced that has these characteristics to a rather definite degree. The regional strains from the above sources, therefore, are recommended in sections where the winterkilling of alfalfa normally is not a serious factor. (Fig. 1.)

Ordinary alfalfa grown west of the Rocky Mountains is very similar in its characteristics to that grown in Kansas, Oklahoma, and Texas, and careful tests indicate it to give approximately the same results in sections having comparatively mild winters. Where winterkilling occurs with a considerable degree of consistency, the strains of alfalfa developed in the Northern States are preferable to

those produced farther south. Regional strains from northern Nebraska, the Dakotas, and Montana are at least somewhat hardier than those developed in Kansas, Oklahoma, and Texas, or the intermountain region, owing, presumably, to the fact that the severe winters of the North have effected the elimination of a great many of the tender individual plants. These northern strains of common alfalfa are seemingly less productive in mild climates than those from the South, but their tendency toward greater hardiness makes their use advisable for seeding in the North.

It is reasonable to assume that where alfalfa is grown under conditions of scant moisture there is some elimination of the less drought-resistant individuals and that if elimination continues throughout a large number of generations a strain superior in drought resistance must necessarily result, just as comparatively hardy strains have developed, for example, in the Dakotas and Montana. It must be admitted, however, that the tests conducted by the United States Department of Agriculture and the results of those published by State agricultural experiment stations have not revealed a materially superior drought resistance of dry-land-grown alfalfa over the common alfalfa grown either under irrigation or where rainfall is fairly abundant. The probable explanation is that the lots which were tested had not come from a sufficiently large number of seed generations grown under conditions of scant moisture. It is very doubtful whether much of the seed offered upon the market as "dry-land" or "nonirrigated" is in the least superior to that grown under irrigation or in the so-called rain belt.

#### PROVENCE.

Provence is the name that is applied to a strain of alfalfa grown in southwestern France. According to the definition formulated at the beginning of this treatise, it is classed as a regional strain of common alfalfa and not as a distinct variety. While it was doubtless introduced into this country at an early date, there is no record of its introduction under the name of Provence until 1898, when the Department of Agriculture procured a small quantity of seed for testing. It was apparently shortly after this date that the name was used commercially and the seed received limited recognition by the seed trade.

The Provence strain differs so slightly in general appearance from the common regional strain from Kansas that one can scarcely be distinguished from the other. There are, however, a few differences of some importance. The Provence commences growth earlier in the spring and continues to grow later in the autumn in the southern part of the United States than does the strain from Kansas. It also makes somewhat quicker growth after cutting. However, it is not

quite as hardy and can not be recommended generally north of the central part of the United States.

While the true Provence strain is an excellent one for sections in which severe winters do not occur, it is not commercially important in this country. Very little seed of it is offered on our markets, and a considerable proportion of that offered as Provence is not true to name. On account of the uncertainty of securing reliable seed, purchasers are advised to buy American-grown seed in preference to it.

#### SPANISH.

Within the past year, and doubtless largely as a result of the war in Europe, there have been imported into this country several thousand pounds of alfalfa seed from Spain. The Department of Agriculture has at various times tested numerous varieties and strains from that country and in general has found them to resemble the Provence alfalfa. It can not advise definitely with regard to the use of the commercial lots that are now being imported until sufficient time has elapsed to give them a thorough trial. It is safe, however, to recommend that the Spanish-grown alfalfa seed be not sown in any of the Northern States, since in all probability the plants resulting from it would not prove to be hardy.

#### TURKESTAN GROUP.

Ever since 1898, when the Department of Agriculture introduced several lots of alfalfa seed from Turkestan, all of the commercial seed coming from that country has been classed under the name "Turkestan alfalfa" regardless of its characteristics or history. The strains introduced by the department were selected from regions having low rainfall and rather extreme temperatures, where they had been grown for many seed generations. These early importations gave such promising results in the cold, dry portions of this country that a demand at once was created for seed from Turkestan. This demand resulted in the importation of miscellaneous lots of seed from all parts of Turkestan where seed could be obtained profitably. In recent years, however, most of the seed that has been imported has come from Russian Turkestan, where it was produced under irrigation. There is, therefore, considerable similarity between the various commercial lots of Turkestan alfalfa.

The alfalfas that have been received from Turkestan as compared with the commercial strains grown in this country are usually characterized by a lower and somewhat more spreading growth, smaller and slightly more hairy leaves, and finer stems. But it is almost impossible even for a trained botanist to distinguish between individual plants of Turkestan alfalfa and those of the American-grown strains, so that confusion often occurs.



Generally speaking, commercial Turkestan alfalfa has proved to be inferior to the American-grown strains in nearly every case where comparative tests have been conducted. In the eastern half of the United States, where alfalfa seed is not produced in commercial quantities, imported seed was used almost exclusively until within the past few years. Of the several million pounds of alfalfa seed that have been imported annually, approximately 95 per cent came from Turkestan. This fact is responsible for many of the failures that occurred with alfalfa

in the Eastern States. In brief, the commercial Turkestan alfalfa yields less than the American-grown strains, is shorter lived, and is less hardy than the Grimm, Baltic, and Canadian variegated. It is therefore not a desirable variety.

Considerable quantities of alfalfa seed are still coming to this country indirectly from Turkestan, regardless of the war in Europe, so that farmers before making purchases should demand the assurance that the seed which is offered them is American grown. Fortunately, commercial Turkestan alfalfa seed can be identified in most cases by the

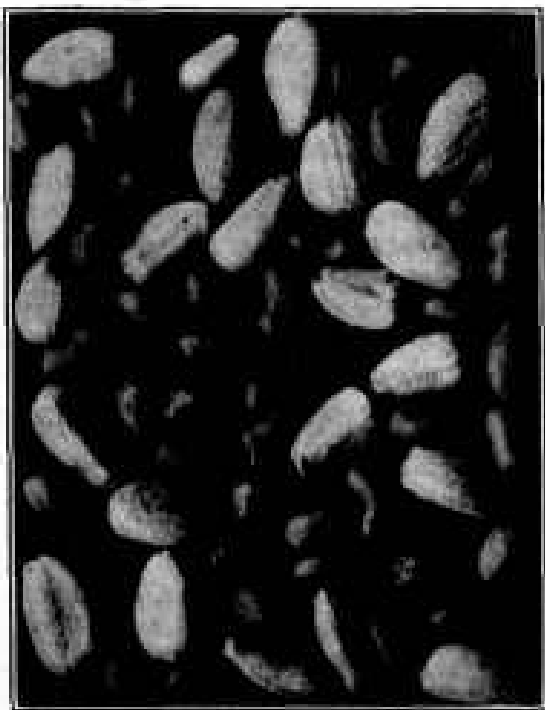


FIG. 2.—Seeds of Russian knapweed mixed with alfalfa seeds. (Magnified five diameters.) This sample shows a much larger proportion of the weed seeds (distinguished by their lighter color and their symmetrical form) than is ordinarily found in Turkestan alfalfa seed.

seed of Russian knapweed<sup>1</sup> which it almost invariably contains. The seed of this weed is not found in commercial alfalfa seed from any other source. Being considerably larger than alfalfa seed, of an oblong shape, and of an ivory, whitish color, it can usually be distinguished with little difficulty. (Fig. 2.)

#### VARIEGATED GROUP.

Wherever the ordinary purple-flowered alfalfa and the yellow-flowered species are grown side by side a natural hybridization takes

<sup>1</sup> *Centaurea pleris*.

place, which results in crosses that show to a greater or less extent the characteristics of both parents. These crosses subsequently intercross among themselves and with the original parent stock, particularly the common alfalfa, thus producing a variety of forms which show considerable range in flower colors. The predominant color of the flowers is the same as of the ordinary alfalfa, but brown, green, greenish yellow, and smoky hues are not uncommon, and occasionally pure yellow flowers occur. It is because of this range in flower color that the name "variegated" has been assigned to the group.

The various members of this group are so similar that it is seldom possible to distinguish between them, but fortunately almost anyone can learn to distinguish a field of variegated alfalfa from one of common alfalfa with a considerable degree of certainty by observing the flower colors and the form of the seed pods. While the greater proportion of the flowers of the variegated alfalfas are the same as those of the common alfalfas, a close examination will reveal some plants having greenish or smoky flowers, and occasionally a pale or yellow one. Furthermore, the seed pods in a field of variegated alfalfa show considerable range in form. Some are circular, semicircular, or loosely coiled, but by far the greater portion of them resemble very closely the compactly coiled pods which alone occur in fields of common alfalfa. In the earlier stages of growth, however, there is no satisfactory way of distinguishing between the variegated and the common groups.

As a rule, the alfalfas that belong to the variegated group are more resistant to cold and drought than the other commonly grown varieties or strains, undoubtedly due in a considerable degree to the presence in their ancestry of the yellow-flowered species. This yellow-flowered species is characterized by its hardiness and drought resistance and occurs naturally over a large portion of Europe and Asia that is too cold and dry for the ordinary purple-flowered alfalfas. It is quite probable that a great many lots of alfalfa that exhibit no marked tendency toward hardiness have some trace of the yellow-flowered alfalfa in their ancestry. Their lack of hardiness may be accounted for partly by the fact that the yellow-flowered species has exerted only a slight influence and partly by the fact that they were probably developed in mild climates. Variegation in the color of the flowers is not positive proof of a variety's hardiness, but it is at least a fair indication. Of the large number of strains of variegated alfalfa in question, the Grimm, Baltie, sand lucern, and Canadian variegated are the only ones that are commercially important. The Cossack and Cherno have been advertised quite extensively, but seed of neither is available in quantity. A few other variegated strains have also been advertised to some extent, but they are at this time of little consequence.

## GRIMM.

According to the account published by the Bureau of Plant Industry in Bulletin No. 209, Grimm alfalfa was introduced into Carver County, Minn., in 1857, by Wendelin Grimm, an immigrant from Baden, Germany. It is said that the original lot of seed, which did not exceed 15 or 20 pounds, was sowed in the spring of 1858. Accounts differ as to its hardiness and the success at first attained with it. However, a sufficient number of plants survived the rather severe winters to enable Mr. Grimm to save small quantities of seed from time to time for future sowings. The first considerable quantity was apparently produced in 1867, when 480 pounds were thrashed from 3 acres and sold in Minneapolis for 50 cents a pound. During subsequent years Mr. Grimm's neighbors attempted to grow alfalfa from seed produced in other parts of the United States, but in practically every case the sowings were entirely winterkilled, while at least some of the Grimm plants came through in good condition. The real value of Grimm alfalfa was not generally recognized, however, until the attention of the Minnesota agricultural experiment station was called to it and efforts were made by that station to extend its culture. In 1905 the United States Department of Agriculture began to experiment with this variety, and since that time it has been grown in comparison with a large number of other varieties and strains, and in practically every case has proved itself equal, if not superior, to any of these in hardiness.

To the casual observer, the Grimm alfalfa does not differ materially from the common strains, but a closer examination will reveal a greater diversity of forms, upright and decumbent individuals often occurring side by side. While a large percentage of the flowers are of the same color as those of common alfalfa, there are a few that are greenish, smoky, or blackish, and occasionally a plant is found with yellow flowers, indicating quite definitely that the strain is the result of a cross between the common and yellow-flowered species. The taproots show a tendency to branch and the crowns to be low set and spreading, characters which are undoubtedly of great importance in rendering a variety resistant to cold. In ability to produce seed Grimm alfalfa is about equal to most of the common strains.

The hardiness of Grimm alfalfa is probably due in part to the presence of the yellow-flowered alfalfa in its ancestry and in part to the processes of natural selection which took place under the severe climatic conditions to which it was subjected for a long period of years in Minnesota. On account of its superior hardiness, the variety is particularly recommended for the northern part of

the Great Plains region and all parts of the Northwest where little protection is afforded by the snow. It has also proved better able to survive the winters in the colder portions of the humid section of the country, where winterkilling is a serious factor. The greater cost of the Grimm seed and the inability of the variety to produce as large yields of hay in a mild climate as the common alfalfa will have a tendency to confine its culture to the more northern States where hardiness is essential to the success of the crop.

When Grimm alfalfa first began to demand attention, all of the seed was produced in Minnesota, but as conditions there are not favorable for seed production, stock was sent to Montana and other Western States in order that the available supply might be more rapidly increased. Carefully conducted tests of Grimm seed produced in Montana, Idaho, and the Dakotas indicate quite definitely that it has not decreased any in hardiness as a result of having been grown for one seed generation under these changed conditions. The supply of seed on the market is still, however, rather limited and commands a high price. As a result, unscrupulous dealers have offered for sale large quantities of common alfalfa under the name of Grimm. Because of this practice, prospective purchasers should take every means possible to learn whether seed is true to name before buying.

#### BALTIC.

There is no authentic record of the introduction of Baltic alfalfa into this country, although there is no doubt that the original stock came from Europe. The name Baltic was first applied to it in 1906, for the reason that it had been grown near Baltic, S. Dak., for about 10 years and not, as has been supposed, in the Baltic Sea region of Europe. The original seed sown at Baltic was purchased from a dealer at Hartford, S. Dak., but further than this no information regarding the history of the seed is available.

While the Baltic differs slightly from the Grimm alfalfa in some minor details, the two are so similar that it is seldom possible to distinguish one from the other, and the description as given for the Grimm variety applies equally well to the Baltic. Although there appears to be some evidence that the Baltic alfalfa produces seed somewhat more abundantly than the Grimm, in general the two varieties may be considered equally valuable.

The Baltic alfalfa has unquestionably been developed in much the same way as the Grimm and therefore owes its hardiness to the same causes; that is, the presence of the yellow-flowered alfalfa in its ancestry and the natural elimination of the less hardy plants which has taken place since its introduction into this country.

This variety is recommended for sections where the ordinary strains suffer considerable loss through winterkilling. This includes practically the same territory to which the Grimm is best adapted; that is, the New England States; the greater part of New York, Michigan, Wisconsin, and Minnesota; the northern Great Plains States; and the northern part of Pennsylvania, New Jersey, Ohio, Indiana, Illinois, and Iowa. It is not recommended for sections where the regional strains of common alfalfa will succeed, as the latter have a tendency to produce heavier yields. Comparative tests have shown very little difference in the hay yields of the Baltic and Grimm varieties.

As in the case of Grimm alfalfa the quantity of Baltic seed produced in the United States is rather limited, and the same precautions are necessary in purchasing it. From the evidence that is now available it is safe to conclude that seed of these alfalfas should be approximately the same price, and the farmer would not be justified in purchasing seed of one at any considerable advance in price over the other.

#### CANADIAN VARIEGATED.

Because of the excellent showing made in the United States by certain lots of alfalfa seed procured from Canadian sources, the United States Department of Agriculture was led to make an investigation of the fields where the seed was produced, most of which are located in lower Ontario. Upon inquiry it was learned that at least part of the original stock came from France, and it is quite probable that some of it was from the sand lucern which is grown in that country as well as in other parts of Europe, since the strain as now produced has its characteristics, including variegated flowers. The fact that it is of hybrid origin, together with the natural selection that has taken place since its introduction into Canada, is responsible for its superior hardiness.

Canadian variegated alfalfa is very similar to the Grimm and Baltic varieties as regards the color of its flowers and its general habit of growth. In fact, these strains are all so much alike that it is seldom possible to distinguish one from the other. It also compares very favorably with the Grimm and Baltic varieties in yield of seed and hay, but, like them, does not yield quite as much as common alfalfa where the latter can be successfully grown. The Canadian variegated has proved more resistant to cold than the common variety and is therefore adapted to the same general region as the Grimm and Baltic alfalfas. In the New England States, and in other States having approximately the same latitude, its superior hardiness as compared with the ordinary alfalfa has been pretty well demonstrated. In tests conducted in the Northwestern States,

however, it has not proved quite as hardy as the Grimm and Baltic varieties.

Practically all the Canadian variegated alfalfa seed imported into the United States is grown in the vicinity of Silverdale, Ontario. As the supply is rather limited, it commands a somewhat higher market price than ordinary alfalfa, although generally selling for somewhat less than seed of the Grimm and Baltic varieties.

#### SAND LUCERN.

It is only during the last 25 years that any attention has been given to sand lucern in the United States, even in an experimental way, although there is little doubt that small quantities of such seed had reached this country many years previous. In 1889 it was grown in experimental plats at the Delaware agricultural experiment station; in 1891 at the North Carolina agricultural experiment station; and near Baton Rouge, La., in 1892. The first noteworthy trial with it was made in Michigan in 1897.

Sand lucern is a hybrid alfalfa and is undoubtedly the parent of our selected strains of variegated alfalfas, such as the Grimm, Baltic, and Canadian variegated. The sand lucern described by the early botanists is quite distinct from the commercial sand lucern. The former probably represents early-generation hybrids, while the latter has been modified by repeated crossings with the common alfalfa.

In general appearance the commercial sand lucern is very similar to the common alfalfa. The presence of the yellow-flowered strain in its ancestry is indicated by the weaker and therefore more decumbent stems, by a certain amount of variegation in the flower colors, and by the presence of some pods with fewer and looser coils. In these respects, as well as in many others, it is quite similar to the Grimm and Baltic varieties.

The commercial sand lucern includes variegated alfalfas that have been grown under all sorts of conditions, and as a result the various lots show no consistent resistance to cold and drought. Some that have been grown for several seed generations under rather severe conditions have become, through natural selection, almost as resistant to cold or to cold and drought as the Grimm variety, while others grown under more favorable conditions are no hardier than the common strains.

The hardier strains of the commercial sand lucern are to be recommended for conditions similar to those under which the Grimm and Baltic varieties have given satisfactory results. The less hardy strains really have no place in this country, because where they succeed the common alfalfa will grow and give larger yields. Owing to the inconsistency in the behavior of the plants grown from various lots

of seed, it is doubtful whether sand lucern should be recommended for general use, particularly since we already have other well-known varieties in the Grimm, Baltic, and Canadian variegated which are equal, if not superior, in hardiness, yield, and seed production to the very best strains of the commercial sand lucern.

#### OTHER VARIEGATED ALFALFAS.

The Cossack and Cherno varieties, which are not as yet commercially important, but which have received quite extensive advertising, belong to the variegated group. A small quantity of seed of each variety was procured by the United States Department of Agriculture from Russia in 1907, and since that time both of them have been tested quite thoroughly by the department.

These varieties are very similar, not only in appearance, but also in value. Since they are comparatively early generation hybrids, their characteristics have not become well fixed. They appear to be hardy and compare very favorably with other hardy alfalfas, but have given no indication of being superior in this respect to the Grimm or Baltic varieties. Only a very limited quantity of seed of either of them is available, and until their superiority over the best commercial hardy varieties and strains has been demonstrated farmers will not be justified in paying the high price that is now asked for the seed.

There are numerous other names that have been used locally in connection with alfalfas belonging to the variegated group, but they have not as yet attracted general attention.

#### NONHARDY GROUP.

There are certain alfalfas, distinct from the regional strains of common alfalfa which have been developed in the southern part of this country, that are especially characterized by long periods of growth and quick recovery after cutting. These alfalfas are so much more seriously affected by low temperatures than the other commercial varieties or strains that for lack of a better group designation they have been classed as nonhardy alfalfas. Commercially only two strains, the Peruvian and the Arabian, have ever attained any degree of importance in this country. Small quantities of seed of other varieties or strains, including the Guaranda and strains from Mexico (which resemble the Peruvian), and the Elche, Algerian, and Oasis (which resemble the Arabian variety), have been imported at various times but have never been grown extensively in the United States.

#### PERUVIAN.

So far as available records show, the Peruvian alfalfa was first introduced into the United States from Peru through the efforts of

the Department of Agriculture in 1899. The first tests conducted in various parts of the United States indicated conclusively that the alfalfa from this source was quite distinct from that commonly grown in this country. Owing to the fact that under favorable conditions it has produced consistently larger yields than other strains and varieties, the acreage devoted to this variety has been gradually increasing.

In general characteristics the Peruvian alfalfa resembles the common variety, but it is sufficiently distinct to be readily distinguished. On the whole, the individual plants of the former are more upright, less branched, and have fewer and somewhat coarser stems than those of the latter. (Fig. 3.) In thick stands, however, the two varieties differ but little in this respect. The leaves of the Peruvian are somewhat larger than those of common alfalfa, being longer and as wide or wider. The most striking characteristic, however, and the one by which this variety may be distinguished most readily is the pubescence, or hairiness, of the whole plant, giving the foliage a grayish appearance.



FIG. 3.—A typical plant of Peruvian alfalfa.

Peruvian alfalfa is characterized by its rapid growth, its quick recovery after cutting, and its ability in sections having mild climates to make growth in cool weather after the growth of ordinary alfalfa has ceased. Under such conditions it commences growth earlier in the spring and continues it later in the fall than do most other varieties, thus lengthening its growing period and thereby giving more cuttings per season. Peruvian alfalfa also possesses the advantage of setting seed more abundantly than most other strains, and in parts of the South it seems to be more resistant than other varieties to certain diseases. Its tendency to become coarse and woody when



allowed to stand beyond the flowering stage may be considered a disadvantage.

Lack of hardiness will always confine the variety to the southern and southwestern portions of the United States, where the winter temperatures are comparatively mild. It can not be grown to advantage in regions where the temperature falls below 10° F. The variety is not drought resistant and therefore is not to be recommended for dry-farming sections.

At the present time Peruvian alfalfa in the United States is mostly grown in Arizona, California, and New Mexico. While the acreage is not large, the results obtained seem to indicate that this area can profitably be extended, not only to other portions of these States, but also to other Southern States.

As in the case of all alfalfas, the Peruvian variety crosses readily with other varieties when mixed or grown in adjoining fields. Such crossing has a tendency to result in the development of hybrid strains that do not possess the distinct appearance of the true Peruvian variety. This has given rise to the opinion that two strains of the Peruvian variety exist, one the hairy and the other nonhairy or smooth, and has brought about the use of the term "hairy Peruvian alfalfa."

#### ARABIAN.

The earliest recorded importation of Arabian alfalfa was made through the office of Foreign Seed and Plant Introduction of the Bureau of Plant Industry in 1902, when two lots were received, one from Basra (Bassorah) and the other from Bagdad, Arabia. From time to time small lots of Arabian alfalfa seed have been received in this country, but in recent years the quantity of such seed imported has been almost negligible.

In general appearance the Arabian alfalfa is not markedly different from some of our common strains, but is readily distinguishable. (Fig. 4.) The plants are typically more hairy, a little shorter in growth, and somewhat more bushy than the ordinary alfalfa. However, the hairiness is not quite so pronounced as in the Peruvian alfalfa. The stems and roots are soft, the former being hollow and quite erect. The crowns spread little and set well above the ground. The leaves are generally larger, lighter colored, and broader in proportion to length than almost any other variety. The imported seed is unusually large, thus necessitating the use of a larger quantity per acre for seeding.

The Arabian variety is characterized by its quick recovery after cutting and by its ability to commence growth earlier in the spring and continue later in the fall than any other alfalfa. This makes it possible under favorable conditions to secure one or two additional

cuttings in a year, but does not result in a corresponding increase in yield.

The greatest objection to Arabian alfalfa is its tendency to be short lived. Under ordinary field conditions a good stand may be maintained for two years. The third year the plants are less vigorous and the stand decidedly thinned out. The fourth year very few plants are left. Another objection is its poor seeding habits in this country, which render the variety rather difficult to perpetuate.

Arabian alfalfa is not cold resistant and can be grown successfully only in sections having comparatively mild winters, such as occur in our Southern and Southwestern States. It is not injured by high temperatures when there is an abundance of moisture in the soil. Because of its inability to resist drought, this variety is not suitable for dry-farming sections.

At the present time the acreage in Arabian alfalfa in the United States is comparatively unimportant, and results secured in most cases indicate pretty clearly that this variety, all things considered, is not equal to either the Peruvian or ordinary alfalfa for general use, even in those parts of this country to which it is best adapted.



FIG. 4.—A typical plant of Arabian alfalfa.

#### YELLOW-FLOWERED GROUP.

In this group are included the various forms of the yellow-flowered species,<sup>1</sup> sometimes referred to as Siberian alfalfas. This term, however, is misleading, since not all of the yellow-flowered alfalfas come from Siberia. While these alfalfas are of comparatively little agronomic importance at the present time, they have been

<sup>1</sup> *Medicago falcata*.

so extensively exploited that it is deemed advisable to discuss them along with the important commercial varieties of alfalfa.

The first importation of any of the forms of yellow-flowered alfalfa of which there is a record was made by the Department of Agriculture in 1898. Accidental introductions, however, occurred before that date. Since 1898 numerous lots of seed have been procured from various parts of Europe and Asia. The plants from these importations vary greatly in their characteristics, including habit of growth. Most of them are procumbent (fig. 5), while a few are nearly as erect (fig. 6)



FIG. 5.—Yellow-flowered alfalfa (*Medicago falcata*), decumbent type.

as the ordinary purple-flowered alfalfas. Few, if any, of the forms possess true taproots, but have a much-branched root system. In general, the crowns are produced somewhat below the surface of the ground, a protective adaptation which enables the plant to endure cold and drought. The flowers are yellow, and the seed pods are crescent or sickle shaped.

The Department of Agriculture has tested many forms of the yellow-flowered alfalfa quite thoroughly in various parts of the country. The results of these tests lead to the conclusion that their chief value is for hybridizing with the purple-flowered alfalfas in order to produce hardy and drought-resistant strains. It is believed that of themselves they are not sufficiently productive to be profitable

under cultivation, since they rarely give more than one cutting in a season. Furthermore, most of the forms are not sufficiently erect to be harvested for hay by field machinery, and almost without exception they produce seed very scantily. A few of the best forms of the yellow-flowered alfalfa give one cutting of hay that frequently outyields the first crop of the ordinary commercial varieties. However, the higher yield in this one crop does not offset their failure to produce more than one cutting in a year.

For use on uncultivated pasture and range lands the tests so far indicate that these alfalfas are not sufficiently aggressive to be of



FIG. 3.—Yellow-flowered alfalfa (*Medicago falcata*), one of the more erect forms.

much value. In fact, it is very doubtful whether even a scattering stand of plants would survive on the average dry range, even if careful attention were given to seeding.

The Department of Agriculture advises farmers to go to no great trouble or expense in testing these yellow-flowered alfalfas at the present time, since there is still much work for plant breeders to do before they can be advantageously utilized.

There are two forms or, rather, two importations that have received considerable attention by reason of being extensively advertised in agricultural journals. They are known as the Semipalatinsk and Orenberg, receiving their names from the Provinces in Siberia and Russia from which they were imported. While these lots are superior in some respects to many other forms of the yellow-flowered alfalfas,

they are composed of mixed strains and are subject to the same objections that apply to the group as a whole.

### VARIETIES OR STRAINS FOR VARIOUS SECTIONS.

In recent years numerous tests have been conducted in all parts of the United States with alfalfas from various sources. These tests have had as their main object the determination of the variety or strain that can be most profitably grown in a specific locality or under certain conditions. As a result of extensive tests it is now possible to designate with considerable definiteness the part of the country where each of the various commercial strains or varieties

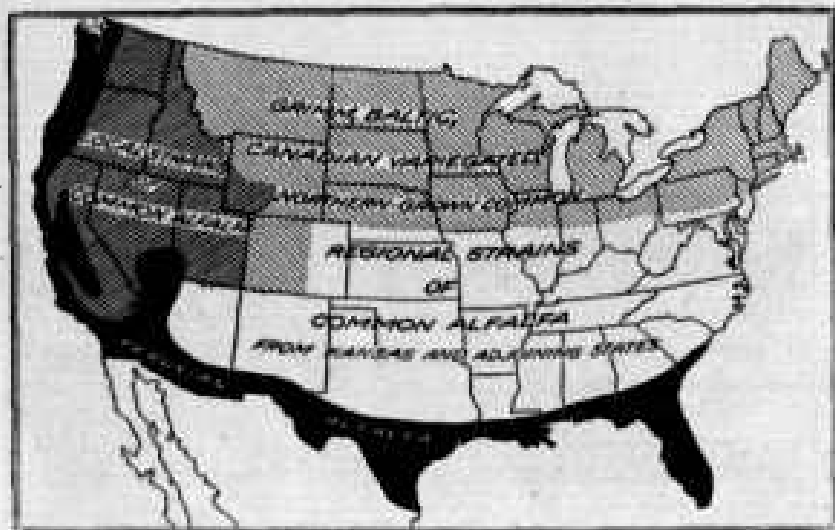


Fig. 7.—Outline map of the United States, showing the varieties or strains of alfalfa that are recommended for various sections, based upon climatic conditions.

may be expected to give the most satisfactory results. (Fig. 7.) There are, however, more or less extensive areas in all parts of the United States where the conditions are so unfavorable to alfalfa that an attempt to produce any of the known varieties or strains is almost certain to result in their failure to grow or in their inability to give profitable yields.

In choosing a variety or strain it is well to bear in mind that the quick-growing alfalfas, because of their tendency to produce heavier yields, should be used as far north as they will survive the winters.

The variegated alfalfas, including the Grimm, the Baltic, and the Canadian variegated, have usually proved more resistant to severe winter conditions than the ordinary strains and therefore give the most satisfactory results where winterkilling is a serious factor. They are not to be recommended generally, however, for conditions where ordinary alfalfas will succeed, owing to the higher cost of

the seed and to the fact that they have a tendency to yield less than the latter under such conditions. As a rule, they may be expected to give the best results in the following States and localities: New England States, New York, Michigan, Wisconsin, Minnesota, Iowa, North Dakota, South Dakota, Montana, Nebraska, northern Illinois, Indiana, Ohio, the greater part of Pennsylvania and Wyoming, and the western half of Colorado. There are, however, areas in several or all of the States mentioned where the soil or climatic conditions are exceptionally favorable to the growth of alfalfa and where the common alfalfa will give more profitable returns. Such areas occur on the limestone soils of New York, Michigan, Wisconsin, and Ohio, as well as parts of Massachusetts, Rhode Island, Connecticut, and Long Island where the climate is modified by proximity to the ocean, thus reducing the losses from winterkilling. If difficulty is experienced in obtaining seed of the Grimm, Baltic, or other hardy variegated varieties for the northern part of the United States, it is recommended that seed of some good northern regional strain be procured. For such conditions these strains generally have proved to be superior to those from farther south.

In sections having very mild winters Peruvian alfalfa has proved more profitable than any other commercial variety or strain, owing to its ability to produce considerably heavier yields. Usually it can be grown to advantage only in sections where the minimum temperature is not lower than 10° F. and where ordinary alfalfa will succeed. The section to which this alfalfa is adapted includes the western portions of Oregon and Washington; the greater part of California, except the mountainous portions; southern Arizona; southern New Mexico; southern Texas; and a strip of country bordering on the Gulf of Mexico and extending northward along the Atlantic Ocean, finally ending in the vicinity of Charleston, S. C. In all the great belt of country lying between the area on the south where Peruvian alfalfa has proved most profitable and the line on the north marking the southern limit of serious winterkilling and extending westward from the Atlantic Ocean to the Rocky Mountains, the common strains that have been developed in Kansas, Oklahoma, Texas, and under similar conditions have given the most satisfactory results. They are somewhat more satisfactory for this area than the common strains from the intermountain region.

In the intermountain region, which embraces practically all the United States not included in the three preceding regions, seed from locally developed strains generally gives as satisfactory results as that from other sections of the country, although here, too, in some of the valleys having high altitudes the Grimm and Baltic alfalfas are preferred. The States or parts of States falling in this group are Idaho, Nevada, Utah, southwestern Wyoming, the mountainous

portions of California, and the greater part of Oregon and Washington.

### PURCHASING SEED.

Before buying alfalfa seed there are three points upon which the purchaser should have information: The name of the variety, the section of the country in which it was produced, and the quality of the seed with regard to both germination and purity. Unfortunately, it is not possible to distinguish between varieties or strains of alfalfa by the appearance of the seed, and the tests that so far have been developed to assist in this connection are not of much practical value to the farmer. Except in the case of imported Russian Turkestan seed, there is no easy means of telling from the appearance of a sample of seed where it was grown. It is important, therefore, that dealings be had only with thoroughly reliable and intelligent seedsmen and growers.

The viability of the seed, or its ability to germinate, is quite clearly indicated in its appearance. Plump seed of a bright olive-green color almost invariably germinates well, while shriveled seed or seed that is of a brownish color usually germinates poorly. With age alfalfa seed turns a reddish brown color, and while some viable seed may possess this color, such seed should not be purchased even if it is offered at a price materially less than that asked for seed of a fresh olive-green color. When a germination test is desired it can be made by placing 100 seeds between cloths or blotting paper and keeping them moist and at a temperature of about 70° F. After five or six days most of the readily viable seeds will have sprouted. There will be some, however, that will remain hard, especially if they are of the variegated varieties. Many of these hard seeds will grow when put in the ground, and therefore they should be considered in estimating the percentage of germination. The Department of Agriculture, through its main Seed Laboratory and branch laboratories, is prepared to make a limited number of germination tests free of charge, but in order to prevent delay samples should be mailed to the department at least two months in advance of seeding time.

With regard to the purity of alfalfa seed, every farmer should be able to recognize readily the most important weed seeds and other impurities that are commonly found in it. Seed to be acceptable should contain not more than 2 per cent of impurities. At the present time there is almost no attempt to adulterate alfalfa seed in this country, but every lot should be very carefully examined for seed of noxious weeds, especially dodder, before it is purchased. The seeds of dodder are smaller than those of alfalfa, more nearly round, and have a pitted surface which can be detected only by the aid of a lens. As dodder is a very troublesome weed and its seeds can not readily be separated from alfalfa seed, dodder-free seed should be

demand by the purchaser. Seeds of buckhorn should always be looked for when samples of alfalfa seed are examined before purchasing. These seeds are shiny brown in appearance, bent shaped, and about twice the length of the alfalfa seed. Seed of Russian knapweed, which has previously been described, should also be searched for carefully, as its presence indicates the imported Turkestan variety. (See fig. 2.) While the Seed Laboratory of the Department of Agriculture is prepared to make a purity analysis of a limited number of samples free of charge for private individuals, it is very desirable that every farmer acquaint himself with the impurities and noxious weed seeds that alfalfa seed commonly contains, in order that there may be no serious delay in purchasing seed for sowing.

### SEED PRODUCTION.

The commercial production of alfalfa seed in this country is confined almost exclusively to that portion lying west of the one hundredth meridian where irrigation and dry-land farming are practiced. Alfalfa does not produce seed satisfactorily under humid conditions, and therefore it is not profitable in a vast majority of cases to attempt to grow seed in the Eastern States. It is true that there are limited areas in these States where comparatively small quantities of alfalfa seed are produced, but they are exceptions. Ordinarily it is very much more profitable for the eastern farmer to purchase seed that is produced in the West rather than to attempt to grow it.

### POSSIBILITIES IN BREEDING.

There are great possibilities in the breeding of alfalfa for the production of strains that will be more resistant to cold and drought or better adapted to special conditions than those that are at present in general use. However, to establish a new strain of alfalfa involves such a long period of time and so much labor and expense that farmers can hardly afford to undertake work of this kind. The breeding of alfalfa, which includes both selection and hybridization, is properly the work of the United States Department of Agriculture and the various State agricultural experiment stations, since these institutions are much better equipped for such work than private individuals. In this country most of the alfalfa breeding is, and doubtless always will be, confined largely to sections west of the Mississippi River, where the conditions are more favorable for the production of alfalfa seed.

### SUMMARY.

At the present time there are recognized in the United States nine fairly distinct commercial strains of alfalfa varying in their adaptations to climatic conditions, some giving the best results in the



North and Northwest, while others succeed only in the South and Southwest, where the winters are mild.

"Common alfalfa" is a term that is used to include all of the alfalfas that are not clearly of hybrid origin or that do not have distinct and uniform varietal characteristics, such as the Peruvian and Arabian varieties. Numerous strains are coming to be recognized in the "common" group. They are often designated by the geographic name of the locality where grown, as Kansas-grown alfalfa, Montana-grown alfalfa, and many others, or by some term descriptive of the conditions under which the crop has developed, such as dry-land alfalfa, irrigated alfalfa, and nonirrigated alfalfa.

Strains developed in the South usually produce larger yields than those developed in the Northern States, but they are less hardy. The "dry-land" alfalfa seed offered on the market has so far failed to show any noticeable superiority in ability to resist drought over that grown with an abundance of moisture.

The commercial Turkestan alfalfa has been tested quite thoroughly in all parts of this country, and in nearly every case has proved inferior to American-grown strains.

The leading commercial strains of variegated alfalfa are the Grimm, the Baltic, the Canadian variegated, and sand lucern. With the exception of sand lucern, they have been found more resistant to cold than other commercial varieties or strains and are therefore recommended for sections where winterkilling occurs frequently.

Peruvian alfalfa is not resistant to severe cold and can be grown successfully only where the winter temperature is comparatively mild, as in the Southern and Southwestern States. Under favorable conditions it outyields any other commercial strain.

Arabian alfalfa is not a satisfactory variety, because of its tendency to be short lived.

As a result of numerous experimental tests the adaptations of the various varieties and strains of alfalfa have been quite definitely determined.

It is highly advisable that the farmer should learn to distinguish good from poor seed. Plump seed of an olive-green color almost invariably germinates well, while shriveled or brown seed generally germinates poorly. The presence of any appreciable quantity of weed seeds or other impurities indicates a poor quality of seed.

Owing to the fact that alfalfa does not produce seed satisfactorily under humid conditions, there is little use in trying to grow it for seed in the Eastern States.

Breeding work with alfalfa offers great possibilities, but the time and expense involved are so great that a farmer can not afford to undertake it.